antithetical to the nature of "rules of thumb." A "rule of thumb" approach to estimating a value is, by definition, a high level estimate that will, if used in each instance and if accurate, produce a reasonable result overall. It is not a means of developing a specific network design. "Rules of thumb" are shortcut methods to deriving an average cost or value for a specific endeavor. Using a "rule of thumb" approach will derive a result that on average approximates the value that would be derived using a more stringent analytical approach. The results produced will, in most specific instances, underestimate or overestimate the actual amount, however, in total the result should be reasonable if the "rule of thumb" is used in each instance. On the other hand, inconsistent use of a "rule of thumb" will skew results.

The Staff in their model has mixed this general "rule of thumb" approach with a more stringent analytical approach to estimate the amount of plant required to serve an area. If the rule of thumb produces lower results, they select that value. If the spanning tree approach produces lower results, they select that value. Obviously, since a "rule of thumb" approach, by definition, will include some results that are greater than and less than the specific amount in any one observation, the FCC approach retains the under-estimations while eliminating all estimates that exceed the more analytically defined results. In other words, combining a rule of thumb approach with the spanning tree analytical approach to determine the amount of needed plant biases the results downward and will produce inappropriately low results.

To illustrate this point, assume someone is planning a dinner party. In planning this party they need to determine how much meat to purchase. One option they have is to use a "rule of thumb" approach. In this instance, the rule of thumb is that each guest will, on average, consume 5 ounces of turkey. Another option available to the host would be to actually survey the participants to determine their desires. Let's assume for the 5 invitees the results of the survey are:

Person	Survey Results
Tom	5 oz
Diane	3 oz
Gary	8 oz
Laurie	2 oz
Lynn	7 oz
Total	25 oz

The "rule of thumb" approach would suggest that the host should prepare 25 (5 people * 5 ounces) ounces of turkey. Similarly, the survey would also suggest that 25 ounces of turkey should be prepared. In contract, under FCC Staff's approach, the specific estimate for each person would be developed using both methods. The lower of the two would then be selected as follows:

Person	Survey Results	Rule of Thumb	FCC Staff Lowest Result
Tom	5 oz	5 oz	5 oz
Diane	3 oz	5 oz	3 oz
Gary	8 oz	5 oz	5 oz
Laurie	2 oz	5 oz	2 oz
Lynn	7 oz	5 oz	5 oz
Total	25 oz	25 oz	20 oz

The "rule of thumb" says you need twenty-five ounces of turkey. A survey of the guests says you need twenty-five ounces. The SM approach says you only need 20 ounces. Someone will go hungry. The method is fatally flawed.

The FCC argues that its cluster by cluster selection of the lowest cost distribution method is logically sound. As can be seen by the above example, the flaw in the FCC's logic is in this assumption - that each and every cluster is fully served by each method. Each of these methods may provide sufficient plant on average, but not necessarily in each instance. If this pillar of the FCC's argument is taken away, the choice of a least cost method becomes an unsupportable reduction in distribution investment. While either method may build sufficient plant based on an internal review of the hypothetical network, this does not mean that both methods build sufficient plant to serve the actual customer base being modeled. Modules providing inputs to the feeddist module make broad standardizing assumptions about customer locations. The FCC should chose one alternative for all clusters to minimize the errors that build insufficient distribution plant. U S WEST recommends that the FCC modify its code to only consider the minimum spanning tree or Prim method for distribution design. The Prim algorithm is a more logical and adaptive method that will continue to work as customer location and clustering improves. U S WEST recommends that the FCC remove its "rule of thumb" code from the feedist module as well as the "-pXXX" command line argument option.

3. The Commission's decision to use a book cost to current cost (BC to CC) adjustment ratio in calculating operating expense factors

Another flaw which would irrationally reduce the size of the fund is the proposed decision regarding the use of a book cost to current cost (BC to CC) adjustment ratio in calculating operating expense factors. On the surface the BC to CC approach appears to have some appeal. However, in practice it has yet to achieve any of the theoretical improvements for which it was designed. Factors are developed by dividing historic expense levels by historical investment or cost levels. These factors are then applied against projected investment levels to determine projected costs or expenses. The denominator in the factor calculation is historic investment or cost levels, yet the factor is applied to future investments to determine future expense levels. Following is a hypothetical example of this calculation:

($40 / $1000) * $950 = $38

where: $40 is historic maintenance expense

$1000 is the historic investment levels

$950 is projected investment levels

$38 is the estimated future expense levels

As illustrated from the above calculation, the projected expense level is lower than the historic levels based solely on the fact that in this example projected plant costs are less than historic plant costs. In other words a projected decrease in the cost of purchasing or placing a piece of equipment would lead to an automatic reduction in the estimated cost of maintaining that equipment. Clearly there is no direct relationship between the cost of purchasing a piece of equipment and the cost of maintaining that equipment as implied by this calculation. For this reason several regional operating companies including USWEST sought a means to eliminate this mismatch. The BC to CC ratio was devised to correct this problem.

Theoretically, the BC to CC ratio would adjust the factor to eliminate the unintentional consequences of using an investment level to develop the factor that does not correspond to the investment level to which the factor will be applied. Following is an example of how, in theory, a BC to CC factor should work using the above example:

$ 1000 / $950 = 1.0526

where: 1.0526 is the book cost to current cost ratio

This BC to CC ratio would then be used to revise the above projected cost calculation as follows:

($40 / $1000) * 1.0526 * $950 = $40

As illustrated the BC to CC ratio eliminates any unintentional impacts caused by the differences between historic and projected investment costs. By eliminating this mismatch between the denominator in the investment factor and the investments to which that factor is applied , the BC to CC ratio theoretically eliminates unsupportable secondary expense adjustments. In other words the BC to CC ratio would insure that all adjustments to expense factors are based on some defensible explicit basis as opposed to being a secondary impact of changes in investment levels that in many instances have no correlation to maintenance costs.

Although theoretically sound, the actual implementation of the BC to CC ratio as it exists in the model today actually increases the mismatch between projected and historic investment levels. As opposed to eliminating unintentional distortions in the expense calculation, current applications of the BC to CC ratio magnify these distortions. As illustrated above, the objective of the BC to CC ratio would be to match the investment used to calculate the factor to the investment to which that factor would be applied. This would create symmetry in the calculation, which would increase its accuracy by eliminating unintentional and unsupportable implicit adjustments to expenses. However, the BC to CC ratios predominately in use in these models actually increase this distortion. This fact is attributable to the fact that the projected or current cost calculation used in the development of factors is not even remotely related to the current costs developed by the models to which the factors are applied. The current costs for the denominator in the BC to CC ratio, is generally developed using a reproduction cost new approach. Reproduction costs are the amount the company would spend to replace the existing technology with identical technology at current prices and placement costs for that technology. It is calculated by applying telephone plant index factors to existing investment levels.

The factors are then applied to a current replacement costs. Replacement costs assume that all the plant is replaced using the most modern placement techniques and the most current available technology. Again, there is a mismatch between the investments used to develop the factors and the investments to which those factors are applied. Following is an example of the new calculation:

$$\frac{\text{Historic Expense}}{\text{Historic Investments}} * \frac{\text{Historic Investment}}{\text{Reproduction Cost New}} * \text{Replacement Cost} = \text{Projected Expense}$$

Simplified the new calculation is:

$$\frac{\text{Historic Expense}}{\text{Reproduction Cost New}} * \text{Replacement Cost} = \text{Projected Expense}$$

Again there is a mismatch between the investment used in the denominator (i.e. reproduction cost) and the investment to which the factor is applied (i.e. replacement costs). In essence this new approach simply replaces the historic investments used in the original calculation with a reproduction cost new investment derived using the telephone plant index.

The question is whether the reproduction cost new used in developing the BC to CC factor a better representation of the replacement costs derived from the models than the historic investments used in the original calculation. No one can argue that both do not represent a mismatch. The issue is which mismatch more appropriately reflects the replacement costs derived by the model. It is U S WEST's experience that reproduction costs derived using a telephone plant index increase this distortion. This is especially true regarding outside plant costs. The reproduction cost new for outside plant investment using the TPI is less representative of the replacement costs derived by the models than historic costs. For instance the TPI would suggest that outside plant costs would be 141% higher if the plant was replaced today using the same technology. Our models generally show that the cost of replacing these facilities would be slightly less if new technologies were employed. Again as illustrated in the previous example, the amount of maintenance expense was arbitrarily reduced from $40 to $38 by the mismatch between the historic investment used in the denominator (*i.e.* $1000) and the replacement costs to which it was applied (*i.e.* $950). For further analysis, assume that the reproduction costs is $1400, based on the outside plant reproduction cost factor of 141% that was derived using the telephone plant index. The new maintenance expense would be calculated as follows:

$$(\$40 \; / \; \$1000) \; * \; (\$1000 \; / \; \$1400) \; * \; \$950 \; = \; \$27.14$$

where:

$40 is historic maintenance expense

$1000 is historic investment

$950 is the projected replacement costs

$1400 is the projected reproduction costs

As illustrated above, the current costs or replacement costs (*i.e.* $1400) used in the BC to CC ratio is less representative of the replacement costs (*i.e.* $950) than the historic investment of $1000. The two dollar distortion that occurred when historic costs were used in the denominator increases to more than $12 when the reproduction cost new is substituted into the equation. The mismatch has been increased as opposed to decreased. The size of the distortion or unjustified reduction in maintenance expense has also been exacerbated.

The concept of a book cost to current cost adjustment in the determination of expense factors is legitimate. However, substituting one mismatch in investment for another mismatch does not achieve the objective of using a BC to CC ratio, unless it can be shown that the substitute investment is more reflective of what is being modeled than the historic book costs.

Reproduction costs new has never been shown to meet this objective. If the FCC believes historic costs adjusted to current costs is a reasonable means of developing TELRIC investments, then there is no reason to have replacement cost models. All expenses can be derived directly by adjusting book investments by the appropriate TPI's for the period of time since they were originally placed in service. If the FCC believes this is not an appropriate means of developing a future looking costs, then it must also reject this approach to developing current costs to use in factor development. The current costs used in the BC to CC ratio must be reflective of the current or future costs derived by the TELRIC models. Reproduction costs new derived using historic investment levels do not meet this objective.

If this Commission believes that productivity and inflation need to be reflected in the development of factors, it should make explicit and identifiable adjustments for these impacts. The Commission should not arbitrarily adjust the factors using a BC to CC ratio that has no relationship to the current or forward looking costs being derived by the models. If TPI adjusted historic investment levels are not a reasonable basis for determining forward looking or TELRIC investments, then they can not be a reasonable basis upon which to adjust forward looking factors. The Commission should not adopt an arbitrary calculation using a number that they themselves would not use in developing their forward looking costs.

II. ANALYSIS OF PARTICULAR PROPOSED INPUTS

A. The Importance of Inputs

The SM is purportedly based on proper economic costing principles and Total Service Long-Run Incremental Cost (TSLRIC) concepts. Its purpose is to estimate the cost of the efficient construction and operation of a local exchange network associated with providing basic local service for a specified geographic region, following TSLRIC principles of forward-looking, efficient costs. These cost estimates provide a basis for estimating the amount of universal service support required to fairly compensate facilities providers for the actual costs of constructing and operating efficient networks and supplying service to high cost customers. Appropriate universal service support will also lead to more efficient investment decisions by facilities based competitors.

Least-cost, most efficient technology is the technology that local telecommunications providers, such as U S WEST, are deploying today. It is not technology that may occur sometime in the future, nor is it necessarily the technology already in place. In the definition of TSLRIC, "long-run" means simply that all costs are variable. Long-run does not mean long time, and long-run costs are not future costs. **Long-run, forward-looking costs** are the costs that would be incurred if we replaced the current network with today's most efficient technology and operating practices. It would be inconsistent with the proper interpretation of the purpose of TSLRIC to estimate today's costs based on productivity gains that U S WEST or some other local exchange carrier may achieve in the future. This practice would always have U S WEST pricing below its current costs, as well as below its properly calculated long-run forward looking costs.

Assuming the replacement of the entire network is a convenient method of forcing all inputs to be variable. This is true even if we assume that the entire network is replaced in one year. By adopting the scorched node requirement in the SM, the model meets the long run criteria. Consistent with the purposes of TSLRIC, to provide efficient and realistic incentives to competitors, only the telephone facilities are scorched, not the facilities of electric and cable companies. Entrants face an environment where electric and cable companies already have networks in place. This has important implications for assigning reasonable values for structure sharing inputs.

There are numerous important inputs in the model. There are a small number of inputs, however, that have received considerable attention in regulatory proceedings over the past two years because they can so drastically affect the results of these models. These include sharing, plant mix, placement costs, line counts, operations expenses, depreciation, and cost of capital.

To produce accurate cost estimates in this environment, inputs must be consistent with each other, consistent with the purpose and rules of TSLRIC, and reflect state-specific information wherever this information provides a reliable guide to forward-looking costs. Inputs and assumptions should interact and build on each other to depict a consistent view of the network and operating parameters necessary to provide universal service. It is important to recognize that even a well-constructed model may allow for the insertion of inconsistent inputs. It is the responsibility of the user of the model to design a set of inputs that are consistent with each other and with the purpose of estimating TSLRIC.

B. Sharing

Sharing inputs determine the percent of the cost of placing a network that the SM will assign to the facilities provider, such as U S WEST. In the SM, sharing inputs are specified for each of the model's nine density zones. Since forward-looking sharing percentages for replacement of an entire network are not readily observable, there is room for reasonable analysts to differ on the precise values for these inputs. There are two key assumptions that are central to establishing a range of reasonableness for the sharing input values. The first is the scorched node assumption. This means that everything is in place except the telecommunications network. Streets, houses, and buildings are in place, as are the cable and electricity networks. This is the TSLRIC world. There is no debate among reasonable analysts that this is the world we are modeling. In the TSLRIC world, the telecommunications network, and only the telecommunications network, is scorched. This means the other utilities are already placed, largely underground. As will be seen, the telecommunications network, if it were built today, would be underground almost in its entirety. The scorched node assumption curtails any widespread opportunity in the TSLRIC world to "share" placement costs with cable and electricity companies, since these companies would not be replacing their entire networks concurrently with the telecommunications build-out.

The second key assumption for establishing a range of reasonableness is that a single facilities provider replaces the entire telecommunications network. This assumption is used in the SM model. Economies of scale that accompany the single provider assumption produce lower per loop cost estimates. The flip side of this assumption is that there are no opportunities to share placement costs with other facilities based telecommunications providers in the TSLRIC world, since other facilities based telecommunications providers do not exist.

Recent experiences by CLECs also provide background to show that the extent of structure sharing that actually occurs today is much less than that assumed in the SM. In a deposition in Iowa, Mr. Kirk Kaalberg, Network Service President of McLeod USA, stated that "we look very aggressively for partners to share our construction costs." Even with the economic incentives for sharing that were cited by the arbitrator in the Iowa interconnection proceeding, Mr. Kaalberg stated that McLeod bears 60 to 75 percent of buried placement costs.[16] Dakota Cable provides another example of the amount of sharing that is actually occurring today. In rebuilding its network in Bismarck, North Dakota, Dakota Cable installed

[16] Deposition of Kirk E. Kaalberg, Iowa Docket No. RPU-96-9, pp. 23, 27-28, 34.

approximately 220 miles of buried cable. Of this total, only about five miles were shared with another utility, indicating that Dakota Cable paid over 98 percent of the costs.[17]

The critical TSLRIC assumptions as well as current experiences such as the two examples referenced above, demonstrate that the SM's default values for sharing (percent assigned to telephone) are inappropriately low and understate the forward-looking cost of providing basic telephone service.

At ¶ 131 the FCC quotes the Nebraska Public Service Commission (NPSC) that there are some opportunities for sharing even in the lowest density zones. The FCC uses this for justification that the costs for buried and underground structure should not be assigned 100 percent to telephone operations. In picking and choosing the sentences to quote from the NPSC, the FCC omits the sentence where the NPSC finds the majority of the structure sharing percentages recommended by U S WEST are reasonable. The full quote is, "The NPSC finds the majority of the structure sharing percentages recommended by U S WEST are reasonable. However, contrary to U S WEST's recommendation, we are unpersuaded that there will be no structure sharing in the "0-5" density zones. Even in these more remote regions of the state, there will be some opportunities for sharing as new homes and businesses are constructed." The following tables display the U S WEST recommendations in Nebraska.

[17] See Direct Testimony of Mark D. Schmidt, North Dakota Docket No. PU-314-97-12, December 22, 1997, pp. 10-11, and Supplemental Testimony of Richard Gosselin, Docket No. North Dakota PU-314-97-465, March 13, 1998, pg. 2.

Percentage Assigned to Telephone: Normal - Feeder Conduit									
Activity	0-5	6-100	101-200	201-650	651-850	851-2550	2551-5000	5001-10000	10001+
Trench & Backfill	100%	90%	90%	80%	80%	80%	80%	80%	80%
Rocky Trench	100%	90%	90%	80%	80%	80%	80%	80%	80%
Backhoe Trench	100%	90%	90%	80%	80%	80%	80%	80%	80%
Hand Dig Trench	100%	90%	90%	80%	80%	80%	80%	80%	80%
Boring	100%	90%	90%	80%	80%	80%	80%	80%	80%
Cut & Restore Asphalt	100%	90%	90%	80%	80%	80%	80%	80%	80%
Cut & Restore Concrete	100%	90%	90%	80%	80%	80%	80%	80%	80%
Cut & Restore Sod	100%	90%	90%	80%	80%	80%	80%	80%	80%

Percentage Assigned to Telephone: Normal - Distribution Conduit									
Activity	0-5	6-100	101-200	201-650	651-850	851-2550	2551-5000	5001-10000	10001+
Trench & Backfill	100%	90%	90%	80%	80%	80%	80%	80%	80%
Rocky Trench	100%	90%	90%	80%	80%	80%	80%	80%	80%
Backhoe Trench	100%	90%	90%	80%	80%	80%	80%	80%	80%
Hand Dig Trench	100%	90%	90%	80%	80%	80%	80%	80%	80%
Boring	100%	90%	90%	80%	80%	80%	80%	80%	80%
Cut & Restore Asphalt	100%	90%	90%	80%	80%	80%	80%	80%	80%
Cut & Restore Concrete	100%	90%	90%	80%	80%	80%	80%	80%	80%
Cut & Restore Sod	100%	90%	90%	80%	80%	80%	80%	80%	80%

Percentage Assigned to Telephone: Normal - Buried Feeder Cable									
Activity	0-5	6-100	101-200	201-650	651-850	851-2550	2551-5000	5001-10000	10001+
Plow	100%	100%	100%	100%	100%	100%	100%	100%	100%
Rocky Plow	100%	100%	100%	100%	100%	100%	100%	100%	100%
Trench & Backfill	100%	90%	90%	80%	80%	80%	80%	80%	80%
Rocky Trench	100%	90%	90%	80%	80%	80%	80%	80%	80%
Backhoe Trench	100%	90%	90%	80%	80%	80%	80%	80%	80%
Hand Dig Trench	100%	90%	90%	80%	80%	80%	80%	80%	80%
Bore Cable	100%	90%	90%	80%	80%	80%	80%	80%	80%
Push Pipe & Pull Cable	100%	90%	90%	80%	80%	80%	80%	80%	80%
Cut & Restore Asphalt	100%	90%	90%	80%	80%	80%	80%	80%	80%
Cut & Restore Concrete	100%	90%	90%	80%	80%	80%	80%	80%	80%
Cut & Restore Sod	100%	90%	90%	80%	80%	80%	80%	80%	80%

Percentage Assigned to Telephone: Normal - Aerial Distribution Cable									
Activity	0-5	6-100	101-200	201-650	651-850	851-2550	2551-5000	5001-10000	10001+
Poles	50%	50%	50%	50%	50%	50%	50%	50%	50%
Anchors and Guys	100%	100%	100%	100%	100%	100%	100%	100%	100%

The SM sharing inputs assume that someone else is picking up a big chunk of the tab when they are not, in actuality, picking up that chunk of the tab. The result is that the ILECs get less support because the fund size is artificially low, but they still incur the costs associated with building a real network in a real world, where the opportunities for "sharing" are minimal, and the desire on the part of other companies to do so is miniscule.

C. Placement Costs and Plant Mix

Placement costs are a function of the **plant mix** (aerial, buried, and underground), the cost of different placement activities, the relative use of different placement activities, and the percent of the cost that U S WEST would bear (structure sharing). The interplay of these inputs determines the estimated cost of placing an entirely new telecommunications network.

Aerial is a relatively inexpensive method of placing cable, and it is fairly easy to find other firms to share pole costs, but due to legal, maintenance, reliability, and aesthetic reasons, aerial placement is declining in use. For the plant mix input, the ILEC's current percent of aerial facilities in a study area provides the most reliable guide available to the aerial plant that would exist in a forward-looking network, although this level of aerial may actually overstate the amount of aerial plant that would exist in a least cost, forward looking network, since current trends are for a reduction in aerial cable.

For buried and underground cable, outside plant engineers use a variety of placement activities. Different field conditions require the use of specific placement activities to place plant in a way that insures network integrity and minimizes cost. The SM uses a single cost per foot input by plant type for each density group. In reality, each density group input represents an average cost of a mix of different placement techniques. Some examples of placement activities include: plow, trench and backfill, bore, and cut and restore concrete.

The relative use of these placement activities is governed by the attempt to place cable efficiently within the constraints of realism. For example, plowing is an inexpensive placement method, but it is used almost exclusively in rural area where it is not necessary to avoid sidewalks, fences, flower beds, and other obstructions common to more suburban and urban areas. Another drawback of plowing is that it is very difficult to share this activity among firms. Trenching is a more expensive method, but it is easier to share than plowing, especially in developing areas where the developer opens and closes the trench. In suburban and urban areas, where it is necessary to use more expensive placement activities, such as boring and cut and restore concrete, sharing opportunities are severely limited by the fact that electric and cable companies already have facilities in place and, therefore, have almost no incentive to share costs with the telephone company.

<u>National versus State Plant Mix</u>

At paragraph 116, the FCC tentatively proposes that nationwide input values for plant mix be utilized in the model. The FCC seeks comment on an alternative to nationwide plant mix input values. U S WEST strongly believes that the SM should utilize study area specific plant mix values that are available in ARMIS as a starting point for plant mix in the SM. State commissions have agreed that a localized approach is to be used.[18]

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[18] See WUTC Docket No. UT-980311 (10th Supp. Order) ¶107 ("The Commission concludes that the models should be populated with a facility mix that reflects the companies' placement decisions in the state of Washington, rather than with national default values."); MPUC Docket No. ***, <u>Report of the Administrative Law Judge</u> (Universal Service Proceeding) ¶ 86 (adopted June 4, 1998); ISUB Docket No. RPU-96-9 (Cost Docket) ¶9; CPUC Cost Docket Decision No. C97-739 (7/28/97) at 24; NMCC Cost Docket Phase I Order ¶¶128-29 (7/15/98).

By default, the SM dictates plant mix percentages (aerial, buried, underground) based on nation-wide defaults. U S WEST is concerned with this approach because it does not accurately model the differences in regions throughout the nation. While the SM can, in some instances, reallocate plant based on a least cost method, the default inputs lock in a mix. This is because if the plant mix percentages add to 100%, the reallocation routine is not triggered and the default mixes all add to 100%.

Additionally, there are other factors influencing plant mix that the SM does not consider. In portions of the US, including many served by U S WEST, severe winter weather makes the maintenance cost of aerial plant much higher than other plant types. Other localized weather conditions mandate the type of plant mix required for the area. [19] Also, aerial plant is frequently prohibited in new developments, as buried cable is perceived as enhancing property value. [20] Indeed, there is a trend toward requiring the conversion of aerial plant to underground.[21]

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[19] See, e.g., WUTC Docket No. UT-980311 (10th Supp. Order) ¶102 ("The type of facility placed by a company is a factor of engineering economic planning which is frequently tempered by the realities of local zoning ordinances, localized weather conditions, and the like. This being the case, a reliance on purely cost minimization considerations in modeling a network would likely result in a plant facility mix that would not reflect the actual type of plant facility that would have to be placed.").

[20] A brief and incomplete search within just two of U S WEST's states came up with numerous provisions requiring undergrounding in new developments. **Washington**: SeaTac Ordinance No. 97-1002; Auburn Ordinance No. 5034 (in addition, conversion to underground required when other utilities underground); Olympia Municipal Code (same); Renton Municipal Code (same); Tacoma Ordinance No. 26053 (same); University Place Ordinance No. 151 (same). See also Bellingham Ordinance 1998-09-074 (city may require undergrounding; conversion to underground also required when other utilities underground); Des Moines Ordinance No. 1200 (same); Federal Way Ordinance No. 95-239 (conversion to underground also required when other utilities underground); Fife Municipal Code (city may require undergrounding); Spokane Municipal Code (same). **Wyoming**: Cody Subdivision of Land Ordinance §30-13(k); Buffalo Subdivision Code §12(f); Jackson Land Development Reg. §4840(A); Evanston Municipal Code §7-41(a); Casper Subdivision Ordinance §16.16.210(C); Laramie Municipal Code §16.12.220; Lander Subdivision and Land Use Regulations; Rawlins Subdivision Code; Gillette Zoning Ordinance. This trend has been observed by state commissions. See WUTC Docket No. UT-980311 (10th Supp. Order) ¶¶ 96 n.26, 102; NMCC Cost Docket Phase I Order ¶128 (7/15/98).

The scorched node scenario dictates that telephone plant does not exist when placing new plant in older neighborhoods. It is reasonable to expect that no more aerial plant would be placed in a scorched node environment than exists today.

U S WEST, especially in the states where it is price regulated, has every incentive to install the least cost plant type. U S WEST's current practices do not utilize aerial at nearly the rate of the SM defaults, either because aerial is not really as efficient as the SM suggests, or because the SM does not consider restrictions on the use of aerial. In either case, the plant mix of today's network is not that of the SM, and the SM is not, therefore, forward looking with regard to plant mix.

U S WEST recommends the use of more accurate and forward-looking plant mix data. The SM contains an optional routine to use of actual plant mix data from ARMIS. Unfortunately, there are several conceptual and programmatic flaws in SM's implementation of the use of actual plant mix data. However, if these algorithms are corrected as described below,

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[21] See local Washington laws cited in footnote **, supra. See also Okoboji (Iowa) Ordinance No. 124 §14; Indianola (Iowa) Municipal Utilities Board of Trustees Resolution No. 87. In Colorado, the General Assembly noted this trend in enacting amended section 29-8-102, which now states in relevant part:

> The general assembly finds that landowners, cities, towns, counties, public utilities, and cable operators in many areas of the state desire to convert existing overhead electric and communication facilities to underground locations. The general assembly further finds that the conversion of overhead electric and communication facilities to underground locations is a matter of statewide concern and interest. The general assembly declares that the public purpose will be served by providing a procedure to accomplish such conversion and that it is in the public interest to provide for such conversion ....

For examples of Colorado conversion ordinances, see Greenwood Village Ordinance No. 3, Series of 1998 §§12.32.020, 12.32.040 (requiring conversion); Longmont Municipal Code §§14.34.010(I), 14.34.030, 14.34.050 (same).

the process will yield the density level plant mix consistent with the study area plant mix data in ARMIS. See **Attachment D** (appended hereto).

D. Line Counts

The SM designs a network for providing basic local service. It is appropriate, therefore, to design this network to serve all lines that would be used to provide basic local service. To the extent that the cost of building the basic local service network could be shared with other services, it is appropriate to reflect these cost savings in the SM. For accurate cost estimates, however, it is important not to overstate the cost savings that could be realistically achieved.

Non-switched special access lines (DS1s and DS3s) are not used to provide basic local service; they are used to provide a low cost substitute to switched access service to high volume customers. The only reason to consider non-switched services, such as DS1s and DS3s, when estimating the cost of loops for providing plain old telephone service (POTS) is the possibility that there <u>may be</u> some economies of scale associated with placing the facilities for non-switched services at the same time as the facilities for POTS loops. These economies of scale are experienced when <u>physical</u> facilities for non-switched services are placed along with POTS facilities. If, for example, loops used for DS1s and POTS are placed in the same trench, the cost of digging the trench can be spread across both sets of loops.

The SM mistakenly increases the line count by including the channel equivalents from DS1s and DS3s. When other models were constructed originally, it was easy to understand why special access lines were counted on an access line equivalent basis. The model builders used ARMIS data, and the FCC required U S WEST to count digital access lines on an access line equivalent basis. Specifically the ARMIS report states that:

> Digital access lines are shown in 64 KB/sec [channel] equivalents. To be classified as digital, the access lines must be terminated at the customer

end as digital lines or be available for use by the customer as digital lines.[22]

During state regulatory proceedings since the passage of the Telecom Act, however, Commissions in numerous states recognized that it is inappropriate to count non-switched digital special access lines on a channel-equivalent basis in a model designed to estimate the costs of loops used to provide POTS and ordered the parties to count access lines for these services on a physical pair basis.

Although counting lines on a physical pair basis is a reasonable compromise position, there are clearly aspects of this compromise that overstate of the economies of scale associated with special access services and loops used to provide POTS. For example, it assumes that facilities for all non-switched services overlap with facilities used for POTS service, which they certainly do not. Nonetheless, since most of the cost understatement caused by including the ARMIS counts of special access services is resolved by counting DS1s and DS3s on a physical pair basis, adopting this solution removes the main source of the understatement of cost.

<u>Inconsistent Line Counts</u>

A fundamental part of the modeling process is identifying line counts. The number of residence lines, business lines and special access lines are critical to determining the proper loop costs. There are two sources of line count data in the SM model. The first is the data from PNR and the second is the 'line count' table in the SM database.

The PNR data resides in a file for each wire center. The file includes the estimated geographical location of each customer and the line count associated with each customer

[22] Statistics of Communications Common Carriers, Federal Communications Commission, Notes for Tables 2.2 Through 2.6, 1994/1995 Edition. Note: A DS1 is 1,544 KB/Sec (1,544/64 = 24) and a DS3 is equivalent to 28 DS1s.

location. There are only two types of records in the PNR files. A customer is classified as either residence or business.

The SM database includes a line count table. This table contains line data by wire center. The types of lines included in the table are residence lines, business lines, special access channels, single business lines and public telephone lines. The source of the data in this table is the ARMIS reports, which reports special access channels not physical lines. The ARMIS data is reported by study area and disaggregated into wire centers. It appears that study area ratios are used to develop the special access line counts by wire center.

In the SM clustering process the PNR business data is 'trued up' to the data in the database. A factor is developed by wire center to adjust the PNR point data to the values in the database. In particular, the business lines in the PNR file are adjusted to match the sum of the database business lines, special access lines and public telephone lines. The implication here being that the PNR business data does not include either special access lines or public telephone lines.

The modified PNR data is used to generate the clusters that are a fundamental building block in the development of loop costs. However, the special access lines and public telephone lines are removed prior to the data being written out for further processing. As a result of this, the modules of the model that develop distribution investment and feeder investment use the PNR data which does not include either special access lines or public telephone lines. The portions of the code that developed special access lines counts in the loop investment modules were made inactive in the last release of the SM model. This is inconsistent with the use of special access lines in the clustering modules.

The next step in the SM process moves the loop investments developed using only residence and business lines to the expense module, where unit costs are calculated. The line counts in the expense module include residence, business, and special access (which incorrectly use channel equivalents). The sum of these three types of lines is used as the denominator in the calculation of unit costs. The result of this calculation is that the cost is severely understated because the cost in the numerator of the calculation is based on a subset of the lines counted in the denominator. This error is further amplified by the use of special access channels.

Fractional Line Counts

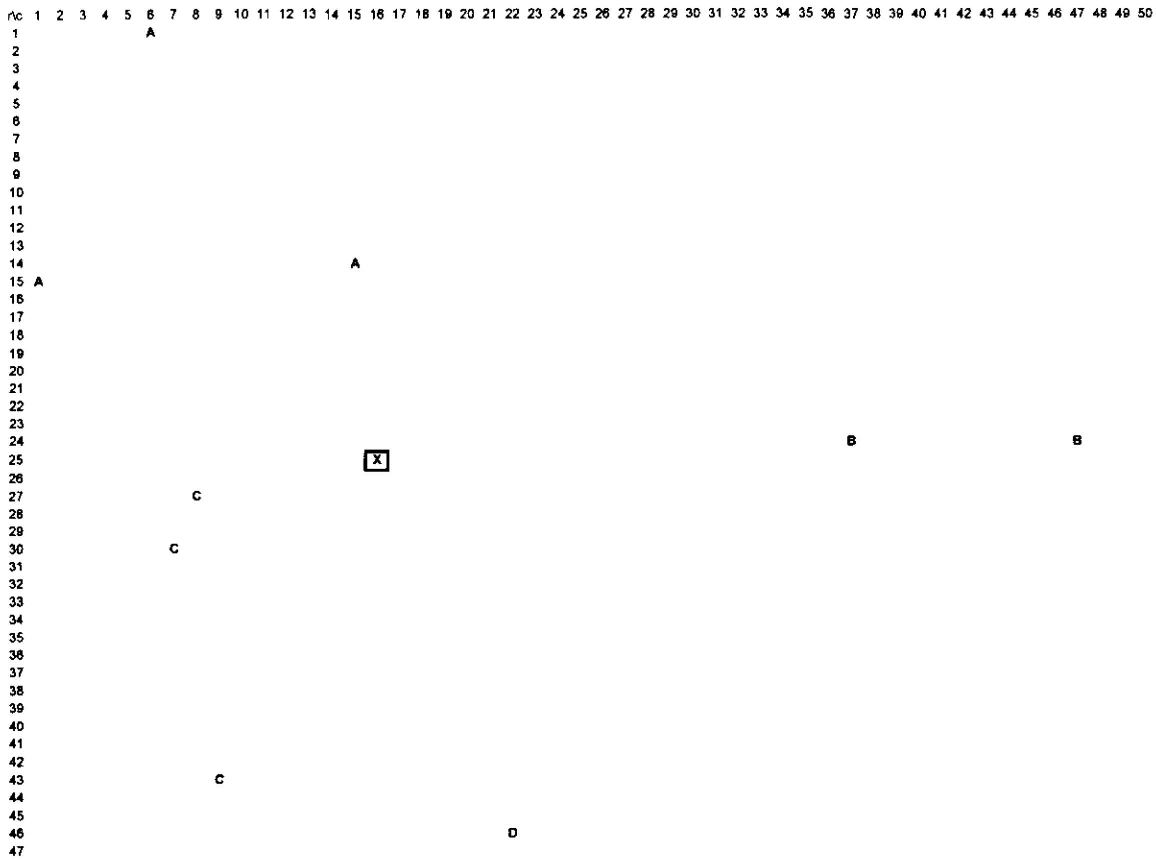
Another area of concern with the line count data is that the PNR methodology produces a significant number of fractional lines at customer locations in the data. Fractional line counts for residence and business locations appear regularly in the customer location data. For example, in the DNVRCOCP wire center there are 5,409 point locations that have less than 1 residential line out of 10,122 total residence point locations. This implies that over 50% of the residence customers don't have a complete line. First of all, theoretically there should be no situations where a residence customer has less that a single line. Either the number of lines or the number of households are misstated. It is impossible to determine the cause of the misstatement because access to the underlying data is not available. Therefore, it is also nearly impossible to offer suggestions to correct the input data. However, a reasonable algorithm would force integral values for the input data whenever possible. Attempts to "work around" the input data can only lead to the mischaracterization of customer locations and line demand.

Fractional Line Impacts

An example of how fractional lines impacts the calculation of costs is shown in the data below. This data was taken from the Douglas, Wyoming (DGLSWYMA) wire center. The table shows the location of each point in the selected clusters, the cluster number and the residence line counts. For the chosen clusters there were no business points.

X	Y	Cluster	Residence Lines	Adjusted Res. Lines
-4537	-123043	42	0.383	0.3820453
-15910	-113890	42	0.383	0.3820453
-9226	-122988	42	0.383	0.3820453
-22777	-133475	42	0.383	0.3820453
-18843	-127586	42	0.383	0.3820453
-22207	-121758	42	0.383	0.3820453
-21439	-115180	42	0.383	0.3820453
-25288	-120851	42	0.383	0.3820453
-25055	-126960	42	0.383	0.3820453
6190	-126475	53	0.383	0.3820453
-15218	-102952	56	0.383	0.3820453
-8302	-108097	56	0.383	0.3820453

Shown below is a rough layout of cluster 42. The individual locations are marked with letters and the cluster centroid, SAI location, is marked with an enclosed 'X'. Each letter designation is meant to show which points share a given quadrant and are in turn processed together. The microgrid numbers are shown along the top and left side of the plot. The graph as shown here represents a mirror image of the data. When processing within the SM the origin is located in the lower left hand corner. For perspective, each of the micrograms is approximately 435 feet by 435 feet.



As a reasonableness check, the distribution distance in each of the three example clusters above is compared to the maximum vertical and horizontal distance (Max V&H).[23] The Max V&H provides a quantitative measure of a minimum amount of cable necessary to reach the widest spread customer points within the input cluster data. This measure does not necessarily provide sufficient cable distance to connect every customer point in the cluster the SAI.

[23] For each cluster the maximum vertical and horizontal distance is calculated as follows: the absolute value (maximum X coordinate – minimum X coordinate) + the absolute value (maximum Y coordinate – minimum Y coordinate).

Cluster Number	Customer Points	Max V & H	SM Distribution Distance	Percent Difference
42	9	40,103	24,796	(38%)
53	1	0	0	0
56	2	12,061	5,640	(53%)

In rural clusters, the distribution distances calculated by the SM are clearly insufficient to connect customer locations to the cluster SAI when there are more than a single customer location. Sparsely populated areas like Douglas, Wyoming are the areas most in need of properly calculated universal service support. The SM clearly does not calculate distribution distances that are consistent with the customer point input data and thus greatly understates cost.

Also shown below are selected columns from the 'distribution output by cluster' worksheet of the HMWKWY5051089999.xls workbook.

Cluster ID	42	53	56
Distribution Distance	24,796	0	5,640
Total Lines	3	1	1
Density - lines/sq mi	2.0896	215.1135	215.1135
Area, sq mi	1.4357	.0046	.0046
Residential Lines	3	1	1
Customer Points	9	1	2
SAI Investment	$150.78	$150.78	$150.78
Terminal Investment	$324.76	$114.55	$114.55
NID Investment	$355.50	$39.50	$118.50

The weighted drop terminal costs for the density involved above are as follows:

Density Zone	Weighted Terminal Cost
0	$114.55
200	$108.25

Given the information above, it follows that there were 3 drop terminals placed in cluster 42 and 1 drop terminal placed in cluster 53 and another drop terminal placed cluster 56. The customers located in cluster 42 and cluster 56 are all located in on distinct lots and are widely dispersed (see diagram of cluster 42 above), as would be expected in a rural setting. For the above data, there should be six additional drop terminals placed in cluster 42 and an additional terminal placed in cluster 56. For some reason the SM fails to recognize this fact and greatly understates the amount of equipment necessary to serve rural customers and therefore greatly